UCRL-JC-121898 Abs

Simulations in a Global Ocean GCM with Stratification-Dependent Isopycnal and Diapycnal Mixing

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We have simulated steady-state temperature, salinity and natural radiocarbon distributions in the world ocean using the LLNL version of the GFDL Modular Ocean Model incorporating the Gent-McWilliams Tracer transport parameterization. We performed simulations using both prescribed isopycnal and diapycnal eddy diffusion coefficients and stratification-dependent coefficients of the form $K_V = a N^{-1}$ and $K_I = b N^{3/2}$, where N is the local Brunt-Viasala frequency. The N-dependent isopycnal diffusivity was derived using the Rossby deformation length as the mixing length and the observed turbulent kinetic-energy dependence on N in the deep ocean. Model runs were made for several combinations of constant and N-dependent diffusivities. Inclusion of stratification-dependence of both the isopycnal and diapycnal components offers the possibility of more realistic simulations of the ensemble mean and transient world ocean climates.

*This work was performed under the auspices of the U.S. Department of Energy by the Lawrence Livermore National Laboratory under Contract No. W-7405-Eng-48.

1. 1995 Fall Meeting

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5. (a)
(b) 1635 Oceans, 4255 Numerical Modeling, 4568 Turbulence,diffusion, & mixing processes, 4520 Eddies & Mesoscale processes
(c) Climate and Global Change

6.N/A

7. 0%

8. P.O.#

9. C

10. N/A

11 Yes